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SMARA UPDATE

The Quarterly Newsletter of the Department of Conservation, Office of Mine Reclamation

Mine Reclamation - A Type of Ecological Restoration

Reclamation, restoration, rehabilitation – these "R" words are used interchangeably to describe a variety of efforts to bring a piece of land back into a more natural or productive state after it has been damaged or altered in some way. The Society for Ecological Restoration (SER) defines **ecological restoration** as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed," with the goal of returning all or nearly all of the physical and ecological processes and biological components of an ecosystem that are historically native to the site. **Rehabilitation** is defined as "any ecologically beneficial treatment short of full restoration." Its goal is to re-establish some of the physical processes and biological components of an indigenous ecosystem.

Reclamation is still less ambitious along this spectrum of goals. To reclaim something is to rescue it from an undesirable condition. The focus is usually on achieving a self-sustaining vegetative cover to protect a site from erosion and blend it in with the surroundings. Generally, reclamation aims at converting land damaged through resource extraction or poor management to a productive use. Using native plants for revegetation and mimicking naturally occurring plant communities help to achieve these goals and bring the damaged land back to a stable condition.

Mined land reclamation certainly fits into this range of activities, qualifying it as a type of environmental or ecological restoration, employing the same principles and practices as

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OFFICE OF MINE RECLAMATION

Inside this issue:

SMARA Workshop Wrap-up

During 2006, the Office of Mine Reclamation (OMR) conducted a series of seven successful training workshops around the state for lead agencies, mine operators, consultants, and other interested parties. On January 18 and 19, 2007, this workshop series concluded with an eighth 2-day session held in the Department of Conservation's home office building in downtown Sacramento.

OMR would like to thank all participants of the *Lead Agency Training* and *Preparation and Review of Reclamation Plans* workshops. These workshops provided an overview of State Mining and Reclamation Act (SMARA) requirements to more than 300 attendees and allowed participants the opportunity to meet and ask questions of OMR staff. Feedback from evaluation forms passed out at the end of each day helped us to improve our performance to better meet participant needs.

OMR Botanist Beth Hendrickson explains the necessary components of the revegetation portion of mine reclamation plans during her workshop presentation.

Photo by John Wesling

OMR is currently developing specialty workshops for 2007, including a *Revegetation* workshop in the spring in Southern California and an *In-stream Mining* workshop in the northern part of the state in the fall. If you have ideas for future training workshops or would like us to schedule a workshop in your region, we would like to hear from you. Check our website for updates!

Leah Gardner Miller
Staff Environmental Scientist

Meet the New Compliance Section Supervisor

OMR's Compliance Section has a new supervisor**: Paul Marshall**. Paul comes to OMR with more than 20 years of geotechnical experience, working in both the private and government sectors.

After receiving an engineering geology degree from San Diego State University, Paul spent seven years working for private consulting firms. Along the way, he obtained California licensure as a Professional Geologist, Certified Engineering Geologist, and Certified Hydrogeologist.

Paul started his state career with the California Department of Water Resources, where he spent nine years conducting technical analyses of a variety of water resources projects. Paul then moved on to the State Water Resource Control Board to take on the challenge of implementing new loan and grant programs.

Paul is looking forward to focusing on mining and applying his experience to help OMR implement an effective SMARA compliance program.

Signposts May Threaten Wildlife

Fence posts and sign posts are a favorite perching spot for raptors. In some cases, however, these man-made perches can be harmful to the raptors themselves.

The U.S. Fish and Wildlife Service has released a notice stating that posts with holes near the top can catch the talon of raptors that use the post as a perch. This can ensnare the bird and lead to its demise. The notice motivated the Department's Abandoned Mine Lands Unit (AMLU) to take a careful look at its own fencing and signage materials used at abandoned mines. Fortunately, AMLU staff determined that the materials used in its installations do not pose a threat to raptors.

Nevertheless, the AMLU has implemented procedures to ensure that its fencing and signage efforts are raptor-friendly.

The AMLU uses heavy duty T-posts when installing fences around abandoned mine shafts. These posts have no holes, and therefore, pose no problem. The signposts typically used by the AMLU are stamped steel with a U-shaped cross section; they have alternating holes and punched tabs roughly every three inches. The top two holes are used for bolts to hold the sign, and the punched tab near the top can be flattened back against the post to eliminate the small gap (see photo).

AMLU sign on standard sign post. Note how the punched tab near the top has been flattened back to eliminate a hole.
Photo by the AMLU

If a different design of post is used that has holes near the top, bolts will be inserted and tightened with a nut to plug the hole. The bolts and nuts will be permanently affixed using a commonly available hardening resin that bonds to steel.

The AMLU recommends that SMARA lead agencies, mine operators, and landowners take similar steps to avoid unnecessary threats to the raptor population.

Jon Mistchenko
Abandoned Mine Lands Unit

Mine Reclamation Photo Contest

Do you have some great before and after mine reclamation photos? If you do, please enter them in OMR's **Mine Reclamation Photo Contest**. The purpose of this contest is to recognize exemplary reclamation projects within the State of California and help OMR develop a library of outstanding mine reclamation imagery for presentations and publications.

Here are some examples of before and after reclamation photos:

BEFORE

AFTER

The two photos above illustrate the restoration of the Corta Alloza & Utrillas Coal Mine in Spain. The two photos below show mine restoration in New Jersey. These photos are used with the permission of the Society for Ecological Restoration's Restoration Showcase.

BEFORE

AFTER

Please visit our website at **www.consrv.ca.gov/omr** for photo contest rules and information on how to participate.

OMR Focuses on Annual SMARA Requirements

One of the primary goals of the Surface Mining and Reclamation Act (SMARA) is to ensure the reclamation of mined lands to prevent or minimize adverse effects on the environment and to protect public health and safety. SMARA meets this goal in part by requiring surface mine operators to post financial assurances that are adequate to perform reclamation in accordance with their approved reclamation plans. Annual inspections and annual adjustments of financial assurances by SMARA lead agencies are critical steps to ensuring that financial assurances are adequate and that reclamation costs are borne by surface mine operators and not by the general public.

Unfortunately, not all lead agencies are meeting these annual requirements. A recent review of inspection reports and financial assurance records maintained by the Office of Mine Reclamation (OMR) indicates that a number of lead agencies have not been performing inspections or recalculating financial assurances annually for surface mining operations within their jurisdictions. In February, OMR sent letters to these lead agencies, urging them to take prompt corrective action.

Before sending the letters, OMR's Reporting Section staff reviewed the files of 460 surface mines that report to these lead agencies. In many cases, the reviews confirmed that these lead agencies have not been meeting the annual inspection and financial assurance adjustment requirements. In all, 16 lead agencies received letters requesting 118 inspection reports and 331 revised financial assurance cost estimates. Copies of the letters were sent to all affected surface mine operators.

Most of the letters contained two lists: (1) mines without inspection reports for the past two or more years, and (2) mines without financial assurance cost estimate adjustments for the past one or more years. Each letter asked the lead agency to submit the required documents within 45 days. If the requested documents are not received within that time, the corresponding mines will be removed from the AB 3098 List. Each affected operator will be given at least 30 days written notice prior to removal from the AB 3098 List. During this period, the operator may appeal the inaction of its lead agency to the State Mining and Geology Board (SMGB) and remain on the AB 3098 List while the appeal is pending, up to a maximum of 180 days. If a surface mine is not on the AB 3098 List and its financial assurance has not been adjusted in one or more years, OMR intends to issue 15-day notices to the corresponding lead agency before taking direct enforcement action against the mine operator.

Annual inspection reports and annual revisions of financial assurances are basic SMARA lead agency responsibilities. Without them, OMR is unable to determine whether a surface mine is operating in compliance with SMARA or whether the amount of its financial assurance is adequate to conduct and complete reclamation. Without them, it may not be possible to prevent or minimize adverse effects on the environment and protect public health and safety. Given their fundamental importance, it is no surprise to find that the failure to meet these annual responsibilities may be grounds for lead agency takeover by the SMGB. OMR hopes that its recent letters will encourage greater compliance by these and other lead agencies and avoid the need for enforcement action.

Douglas W. Craig
Assistant Director, Office of Mine Reclamation

ECOLOGICAL RESTORATION *(Continued from page 1)*

other types of restoration projects. Removing large quantities of minerals and overburden disrupts the land surface, temporarily removing the topsoil and vegetative cover, and making the site susceptible to erosion and further degradation. Ecological processes and species richness are temporarily lowered.

Ecological Restoration is an exciting field built on the science of ecology and bringing together many disciplines, such as conservation biology, engineering, hydrology, landscape architecture, and horticulture. Contractors specializing in ecological restoration are well suited to design, implement, and maintain mine reclamation projects. Environmental restoration principles and practices are being applied to a wide variety of projects in every type of ecosystem on every continent. The subject is now taught at many colleges and universities. For example, the University of California, Davis offers bachelors and masters degrees in Restoration Ecology through its Environmental Horticulture department.

Revegetation is an important component of any environmental restoration project. Here, a California Conservation Corps crew is planting and caging oak trees as mitigation for a pipeline project. Native grass seed and mulch is being applied to reduce erosion and blend the site with the surroundings. The same principles and practices would be used to reclaim a quarry.

Photo by Beth Hendrickson

"Ecological restoration is not only escalating at an astounding rate, but also remains the most ecologically viable and aesthetically appealing remedy for mending the Earth's ever-increasing number and scale of degraded ecosystems." (Falk, et al, 2006).

Mine reclamation should be viewed in the context of something broader, as an offshoot of the science and practice of Restoration Ecology, and as one of many types of projects aimed at mitigating and repairing damage to the land and enhancing biodiversity that is being implemented all over the State and around the world.

The following organizations provide websites, publications, and conferences on **Ecological Restoration**. You may want to attend the annual SERCAL conference held each October, as members of the OMR Reclamation Unit have done for many years in order to keep abreast of the latest trends in the science and practice of restoration. You can see case study examples of a wide range of restoration projects, including mine reclamation projects all over the state. The 2007

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conference will be held in San Diego on October 23-25. Founded in 1987, the Society for Ecological Restoration International (SER) is an international, non-profit organization whose mission is to promote ecological restoration as a means of sustaining the diversity of life and reestablishing an ecologically healthy relationship between nature and culture (for more information, visit *www.ser.org*). SERCAL will hold its annual conference next August 5-10 in San Jose. The 2007 theme will be "Restoration in a Changing World."

Participants at SERCAL's 13th Annual Conference held in October in Santa Barbara peruse the posters, booths and displays exhibited by vendors and consultants involved in environmental restoration.

Photo by Leah G. Miller

SERCAL was founded in 1991 as the first state chapter of SER. In 2000, SERCAL elected to separate from SER and was reorganized as **The California Society for Ecological Restoration**, an independent nonprofit, public benefit corporation. SERCAL no longer has any organizational or financial affiliation with SER International (visit www.sercal.org for more information). Over the years, SERCAL has been strongly dedicated to the following objectives:

- To advance the science, art, and practice of ecological restoration.
- To educate members and the public on sound scientific strategies and techniques of protecting, restoring, and monitoring native habitat.
- To develop and promote ethical standards for practitioners in the field of ecological restoration.
- To facilitate communication among professionals and others with an interest in ecological restoration.
- To advise and consult with public agencies and appropriate entities regarding the improvement of standards and criteria for ecological restoration.

Further reading on the subject of **Environmental Restoration**:

- *Environmental Restoration: Science and Strategies for Restoring the Earth*. John J. Berger (ed.) 1990
- *Repairing Damaged Wildlands: A Process-Oriented, Landscape-Scale Approach*. Steve G. Whisenant, 1999.
- *The Science and Practice of Ecological Restoration*. James Aronson (ed.), 2004.
- *Foundations of Restoration Ecology.* Donald A. Falk, et al., 2006

Leah Gardner Miller
Staff Environmental Scientist

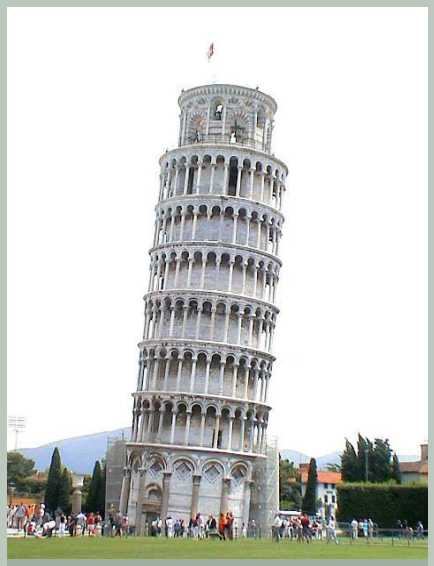
Fill Compaction for Urban End Uses

The Irwindale Business Center was constructed on a former rock quarry in the heart of the City of Irwindale, California. More than one-half of the business center is built and occupied. The overall development will eventually include 2.1 million square feet of quality industrial and retail space.

Photo by the City of Irwindale

Successful reclamation of mines to urban end uses typically has an overall positive effect on local communities and provides financial benefit to mine operators. Reclamation activities typically include grading to sculpt final areas of cut and fill and blending them into the surrounding topography. For filled areas, improper compaction can lead to problems for subsequent urban development, such as foundation erosion, differential settlement, piping and erosion gullies beneath abutments, pipe breaks and leakage, slab cracks, basement and swimming pool cracks and leaks and slope instability. Building codes are designed to protect structures that are sensitive to settlement, as well as to promote overall site stability.

So, it's not surprising SMARA regulations provide that performance standards for backfilling, regrading, slope stability, and recontouring for urban end uses should follow the current version of the Uniform Building Code (UBC) as adopted by the lead agency.



Although not constructed in a former mine, the Leaning Tower of Pisa is an historic tourist attraction because of its architectural style and differential settlement due to improper compaction of foundation soils. Millions of dollars have been spent trying to arrest the settlement.

Photo by Massimo Adami

<u>Soil Compaction</u>

Soil compaction is the process of increasing soil density by mechanically reorienting soil particles and reducing pore space. The UBC specifies that fills should be compacted to a minimum of 90 percent of maximum density. Fills designed to bear loads may require higher compaction levels, even levels that exceed the standard Proctor, a common compaction laboratory test. Fills that will not bear the loads of buildings or other structures may fall closer to the 90 percent.

It is important to note that while these compaction levels promote mechanical stability of the soil, they are generally too high to support revegetation efforts. Near-surface (e.g., upper 2 to 3 feet) soils that will not bear loads may require less compaction if vegetation is expected to survive and flourish. Some studies indicate that vegetation can establish with a compaction level between about 80 and 85 percent of the standard Proctor maximum dry density.

Controlling soil moisture content is an important element of the compaction effort, because water acts as a lubricant to allow soil particles to slide together. A soil with a particular texture needs just the right amount of water, called its ideal or optimum moisture content, to achieve maximum density. The presence of too much moisture may

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FILL COMPACTION *(Continued from page 8)*

result in improper compaction because any water-filled voids will not allow the soil to compress. On the other hand, the presence of too little water also will result in improper compaction by not allowing soil particles to easily slide past one another.

Site Preparation and Fill Placement

To achieve proper compaction and stability, the UBC identifies requirements for preparation of the substrate on which the fill will be placed, and for the placement and composition of the fill. Fill slopes should be inclined no steeper than 2 units horizontal to 1 unit vertical. The ground surface should be prepared in a proper manner to receive fill, including removing vegetation, noncomplying fill, topsoil and other unsuitable material. Underlying material should be scarified to provide a good bond with the new fill, and benching of the slope is required where underlying slopes are steeper than 2 units horizontal to 1 unit vertical. Detrimental amounts of organic material should not be permitted in fills. No rock or similar irreducible material larger than 12 inches should be buried or placed in fills. Building codes may allow exceptions to requirements if documented in an approved soils engineering report, and requirements may be waived for minor fills not intended to support structures.

Construction of a 423-unit residential development in the former Leona Quarry in Oakland.

Photo by Leah G. Miller

Compaction Methods and Monitoring

Methods of achieving proper compaction include vibrating, impacting, kneading, and/or adding deadweight to the soil. The desired level of compaction is accomplished by utilizing the proper method and equipment for the soil type. Fine-grained, cohesive soils, such as silt and clay, respond well to impact, pressure and kneading methods. Coarse-grained, granular soils, such as sand and gravel, respond well to vibration and kneading. Equipment such as vibrating sheepsfoot, rammers, vibrating plate compactors, and vibrating rollers are methods of impact and vibration. Heavy equipment that imparts pressure and kneads soil includes the static sheepsfoot roller, grid roller, scraper, and front-end loader. Other factors, such as site layout and conditions, may influence the actual equipment used on a given site.

Individual fill layers placed for compaction, informally referred to as “lifts,” should not exceed 12 inches in thickness. Granular soils may be placed at the full 12-inch thickness, but it may be advisable to place cohesive soils in thinner lifts. To ensure that the fill is being properly placed and compacted, it is important to monitor and document the density of the fill lifts during compaction. Common field testing methods to determine soil density include sand cone, balloon density meter, Shelby tube, and nuclear gauge.

OMR recommends contacting a qualified geotechnical engineer to address proper compaction and site grading for urban end uses.

John Wesling
Engineering Geologist

A Partnership Blooms in the Desert

Four years ago, a partnership was created in San Bernardino County between the Victor Valley College (VVC), local mining companies, and the Mojave Water Agency. The local mines include Mitsubishi Cement, Specialty Minerals, OMYA California, Inc., and Rio Tinto Minerals (formerly US Borax). Dubbed the Mojave Sustainability Project (MSP), the collaboration has blossomed into a mutually beneficial relationship. The mining companies pay the college to raise plants in their nurseries and perform research on the best techniques for successful reclamation.

Students and conference attendees get a tour of reclaimed benches of the Mitsubishi Cement Quarry in Lucerne Valley.

Photo by Leah G. Miller

Students get training and hands-on experience in mine reclamation with VVC's Agriculture and Natural Resources Department, chaired by Neville Slade, a native of South Africa. Classroom courses combined with lab work, field studies, and internships allow students to learn about soil, plant, and water sciences, environmental studies, native plant identification and propagation, restoration ecology, geospatial technologies, and nursery and greenhouse management. They can earn a vocational certificate or an associate's degree in Environmental Horticulture, or they can transfer to a university for further education.

This VVC campus research project tests different methods of treating the seeds and the ground surface to achieve the best germination results for creosote bush, *Larrea tridentata*.

Photo by Leah G. Miller

Innovative, student-led revegetation projects with the local mines have added significantly to the success of restoration at these sites. Over 2,500 campus-grown plants have been installed, with an average survival rate of 70 percent—an unusually high level of success in the desert. In addition to planting container plants grown in the greenhouse from seeds collected on site, methods for salvaging and transplanting species such as yuccas and cacti are being developed, and seed mixes and methods of seeding are being tested. The students maintain a seed bank for more than 70 species of Mojave Desert plants, with a GIS system to manage data

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A Partnership Blooms in the Desert *(Continued from page 10)*

on the locations and dates of the seed collections. Plant sales are held each spring and fall, and are open to the public.

In addition to ongoing research, plant propagation, and reclamation projects, VVC hosts an annual Mojave Restoration Summit sponsored by the MSP partners. OMR staff participated in this year's conference, offering slide presentations on various mine reclamation topics and supplying the textbook for participants. The book, *Rehabilitation of Disturbed Lands in California; A Manual for Decision Makers*, is available as a downloadable PDF file from the OMR website at http://www.consrv.ca.gov/OMR/reclamation/index.htm

A combination of container-grown plants, salvaged plants, and seed, irrigated for the first year, is leading to high revegetation success. The biodegradable cages protect plants from rabbits, ground squirrels, and Nelson bighorn sheep.

Photo by Leah G. Miller

Born from the success of these strategic partnerships, the MSP is a multi-faceted collaborative that serves as an educational forum, providing a key information conduit that engages the community and enhances the landscape. It serves as a real-world training ground for future natural resources professionals. The MSP is a successful model for how community partnerships between academia, government, and industry can serve to address significant regional, social, environmental, and economic issues. The MSP partnership has proven that mines and colleges can work together to achieve mutually beneficial, successful reclamation, and might serve as a template for other parts of the state.

For more information, visit Victor Valley College's website at http://www.mojavesustainability.org

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The purpose of this publication is to impart the latest reclamation tips as well as changes in SMARA-related legislation or the interpretation of existing statutes by court decisions.

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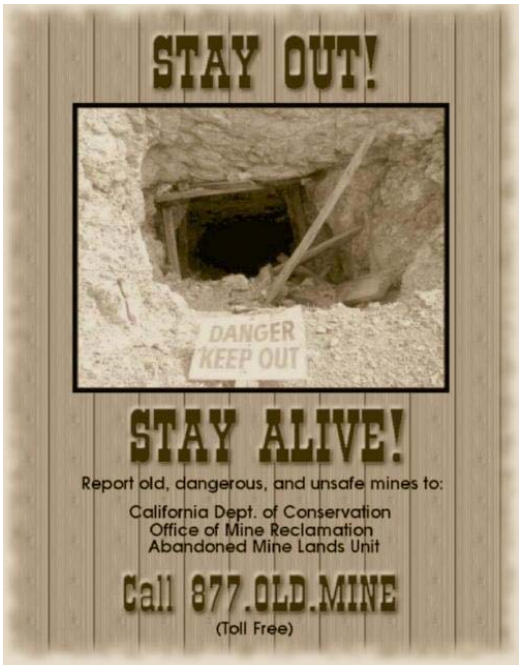

Pictured from left to right are: Chris Higgins, DOC Director Bridgett Luther, Sam Hayashi, Sarah Reeves, and Jon Mistchenko.
Photo by Lynne Taylor

Three Abandoned Mine Lands Unit staff earned the Department of Conservation's Employee of the Month award in October 2006. Sam Hayashi, Sarah Reeves, and Jonathan Mistchenko received the honor, along with Chris Higgins from the California Geological Survey, for their hard work following a fatal accident in Alta, California. Placer County officials still have not determined whether the accident was related to the underground workings of an abandoned mine. In the two weeks following the accident, the AMLU received and responded to many calls to their toll-free hotline (1-877-OLD MINE) from concerned citizens.

OMR - Ensuring mined lands are returned to a beneficial end use after mining.